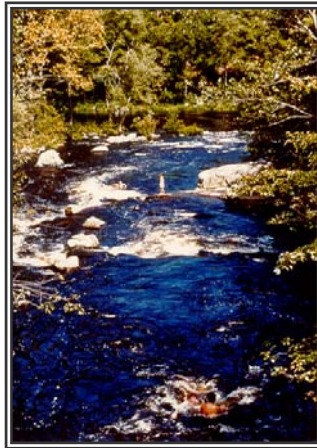


# **New Hampshire Volunteer River Assessment Program**

## **LAMPREY RIVER**

**2001**

### **Water Quality Monitoring Report**



February 2003

**STATE OF NEW HAMPSHIRE**  
**Volunteer River Assessment Program**  
**2001**  
**LAMPREY RIVER**  
**Water Quality Report**

*STATE OF NEW HAMPSHIRE  
DEPARTMENT OF ENVIRONMENTAL SERVICES  
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February 2003

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Appendix A: List of Stations

Appendix B: Raw Data Tables

Appendix C: Water Quality Parameters and Surface Water Quality Standards

Appendix D: River Graphs

Appendix E: Field Sampling Protocols

## 1. ACKNOWLEDGEMENTS

The New Hampshire Department of Environmental Services-Volunteer River Assessment Program extends sincere thanks to the volunteers of the Lamprey River Watershed Association during 2001. This report was created solely from the data collected by the volunteers listed, below. It is their time and dedication that not only contributes to the amount of knowledge of rivers and streams in New Hampshire, but also expresses the genuine concern for local water resources.

Tony Federer  
Filson Glanz  
Gael Grant  
John Hamden  
Bill Henze  
Barry Kane  
Tracy Kane  
Scott Lathrop  
Dick Lord  
David Meeker  
Sharon Meeker  
Carl Spang  
Judith Spang  
Mark Weritz  
Maryann Wortley



## 2. VOLUNTEER RIVER ASSESSMENT PROGRAM OVERVIEW

The Volunteer River Assessment Program (VRAP) supports watershed organizations in their efforts to monitor river water quality. The primary focus of VRAP is to provide volunteers with river monitoring guidelines, equipment loans, and technical training. DES also incorporates applicable volunteer monitoring results into its evaluation of New Hampshire surface waters. Annual reports for each VRAP river include a summary of monitoring results and recommendations for future water quality sampling. VRAP aims to foster public understanding and stewardship of river systems and to increase available water quality information about New Hampshire rivers and streams.

VRAP loans and maintains water monitoring kits that include meters and supplies for on-site measurement of five basic water quality parameters: water temperature, dissolved oxygen, pH, specific conductance (conductivity), and turbidity. The investigation of these and additional parameters such as nutrients, metals, and bacteria is conducted by state water quality personnel and may be augmented by volunteer sampling. Sampling additional parameters comes with the cost of analysis, which can be covered by an assortment of fundraising activities such as association membership fees, special events, and in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. Water quality results are also used to determine if a river is meeting surface water quality standards. Volunteer monitoring results meeting DES's Quality Assurance and Quality Control (QA/QC) requirements supplement the efforts of DES to assess the condition of New Hampshire surface waters. The New Hampshire Surface Water Quality Regulations are available through the DES Public Information Center at [www.des.state.nh.us/wmb/Env-Ws1700.pdf](http://www.des.state.nh.us/wmb/Env-Ws1700.pdf) or (603) 271-1975.

VRAP typically recommends sampling every other week during the summer, and citizen monitoring groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions. Each year volunteers arrange a sampling schedule and design in cooperation with the VRAP Coordinator. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency.

Each VRAP volunteer must attend an annual training session to receive a demonstration of monitoring protocols and sampling techniques. Training sessions are an opportunity for volunteers to come together and receive an updated version of monitoring techniques. Training sessions are typically conducted outdoors near surface waters for an interactive demonstration. During the training volunteers have a chance to practice using the VRAP

equipment and may also receive instruction in the collection of samples for laboratory analysis. Training is accomplished in approximately three hours, after which volunteers are certified in the care, calibration, and use of the VRAP equipment.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. VRAP aims to visit volunteers during scheduled sampling events to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. Volunteers forward water quality results to the VRAP Coordinator for incorporation into an annual report and state water quality assessment activities.

Applicable volunteer data are input to a water quality database, and considered (along with other reliable sources of data) during periodic DES water quality assessments. Assessment results and the methodology used to assess surface waters are published by DES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act.

More than fifty VRAP volunteers sampled seven rivers regularly during the year 2001. VRAP 2001 rivers include the Lamprey, Exeter, Cocheco, Powwow, Sugar, Ashuelot, and Oyster rivers, as well as preliminary sampling on several additional rivers and streams. These accomplishments were made possible by the hard work and dedication of citizen volunteers and many additional people who helped to plan, support, and carry out these monitoring efforts.

### **3. PROJECT SUMMARY: LAMPREY RIVER VRAP 2001**

In 1998 the Lamprey River Watershed Association (LRWA) spearheaded the formation of a volunteer water quality monitoring program on the Lamprey River. Monitoring has been accomplished through a partnership among several groups with a strong interest in the health of the river, local wildlife, aquatic recreation, and the educational opportunities the river offers us all. The LRWA and other watershed residents have monitored the river for several years, and have been successful in expanding the sampling program.

During 2001, sampling was focused on nine stations along the river from Epping to Newmarket. Samples were collected every two weeks, beginning in June and concluding in September.

### **4. RESULTS, DISCUSSION, AND RECOMMENDATIONS**

This section includes a description of the Lamprey River VRAP 2001 monitoring locations and results, a discussion of the results in comparison with New Hampshire water quality standards, and recommendations for future sampling and watershed investigations. The VRAP monitoring locations, "stations", are discussed from upstream to downstream (see Appendix A for a list of stations). Results are presented in graphs and text prepared by VRAP, and tables including all monitoring results from each station

are located in Appendix B. The discussion of the results includes recommendations for future sampling and investigations that will contribute to the assessment of water quality conditions.

The water quality information collected at each station is summarized in a table that provides the reader with an overview of the monitoring activities and results. The table can be used as a quick reference for the reader; results not meeting state water quality criteria do not necessarily indicate a violation of water quality standards. The summary table indicates: (1) the number and type of samples collected, (2) the number of samples collected according to quality assurance and quality control requirements, (3) the number of samples not meeting state water quality criteria, (4) the range of the measurements, and (5) abbreviated water quality standards.

The presentation and discussion of the volunteer results focuses primarily on three parameters: DO, temperature, pH, and bacteria. These parameters are the core of the VRAP monitoring system, and have relatively straightforward standards that lend themselves to the assessment of individual results. These results can contribute directly to the determination of fishable and swimmable river and stream conditions, which is often a primary volunteer monitoring goal. This section includes graphs of dissolved oxygen (DO) concentrations with water temperature, and *E. coli* bacteria results (if collected). Please see Appendix C for descriptions of the water quality parameters analyzed under VRAP during 2001 and the associated New Hampshire surface water quality standards (SWQS) for Class B waters.

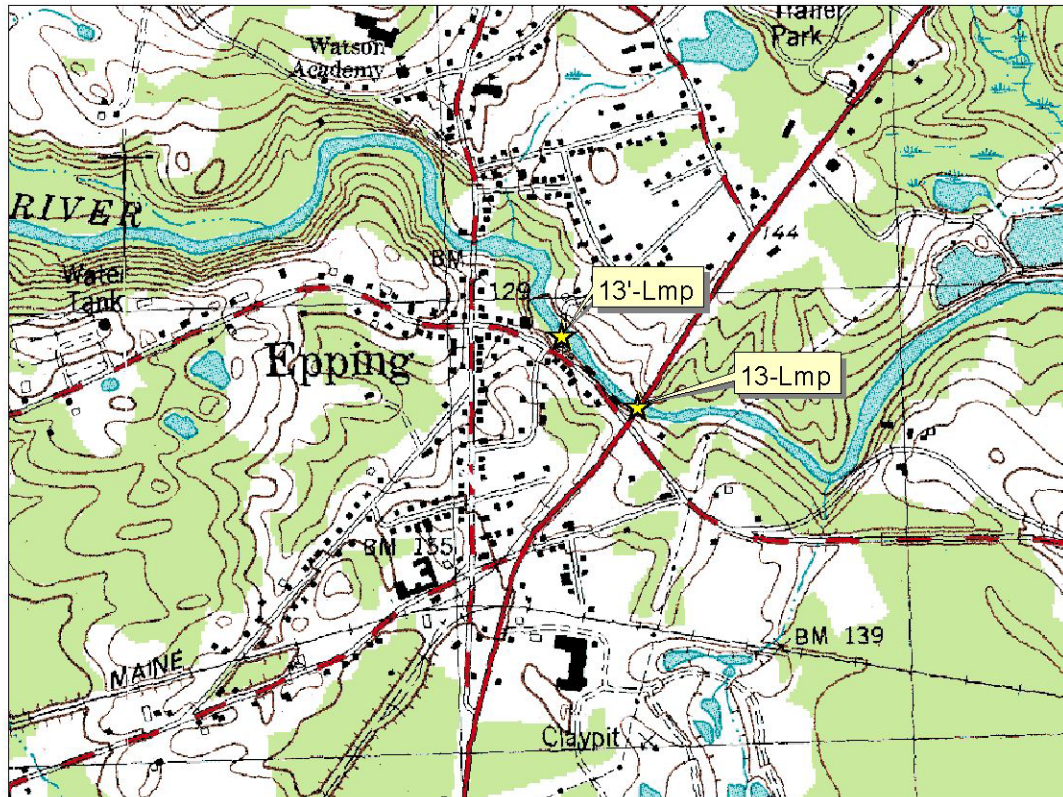
The current report format will describe water quality conditions on a station-by-station basis. The reader should note that discussion is limited to those parameters at each station that do not meet state criteria. For example, since pH is the only parameter at 13'-Lmp that exceeded state criteria, only pH will be discussed in detail. However, recommendations are not limited to parameters with results that fall outside state criteria.

VRAP aims to provide a mechanism for citizens to contribute to the ongoing process of surface water quality assessment. Recommendations for future monitoring activities and watershed investigations are included in this report following the results and discussion. Also included are recommendations for improvements in sampling techniques to encourage volunteers to adhere to quality assurance and control measures.

Volunteers are encouraged to sample their rivers and streams on a long-term basis. Much of the information volunteers collect profiles river and stream locations for the first time. Several (five to ten) years of good quality measurements will be needed to begin to decipher water quality trends and the status of rivers and streams relative to the New Hampshire surface water quality standards. Water quality data from the stretch of river sampled by volunteers are presented in graphs in Appendix D. These graphs are included in the report to show how water quality conditions change from upstream to downstream. All results generated by the Exeter River VRAP 2001 were collected using the VRAP Field Datasheet and Field Sampling Protocols, 2001 (see Appendix E).

#### 4.1. 13'-Lmp: Mill Street Bridge, Epping, NH

### 13'-Lmp: Mill St. Bridge, and 13-Lmp: Rt. 125 Bridge Lamprey River, Epping, NH



0.1 0 0.1 0.2 0.3 0.4 0.5 Miles

## Legend

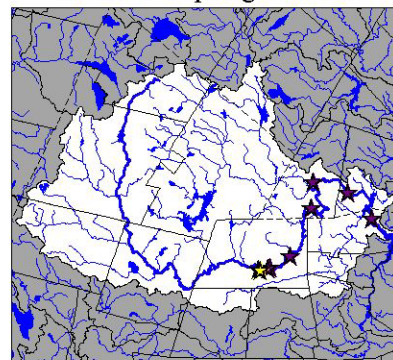
- ✕ Dams
- ★ Sampling Station

The coverages presented in this program are under constant revision as new sites or facilities are added. They may not contain all of the potential or existing sites or facilities. The Department is not responsible for the use or interpretation of this information, nor for any inaccuracies.

Map Prepared October 24, 2001.



### Lamprey River Watershed VRAP Sampling Stations



(Bright star indicates featured station)

#### 4.1.1. Results and Discussion

Eighteen measurements for dissolved oxygen, pH, turbidity, and conductivity were made in the field using handheld meters (Table 1). Ten samples were collected for *E. coli* bacteria. All measurements and samples met the QA/QC requirements. One pH measurement was below the Class B water quality standard. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.1.1.1, below).

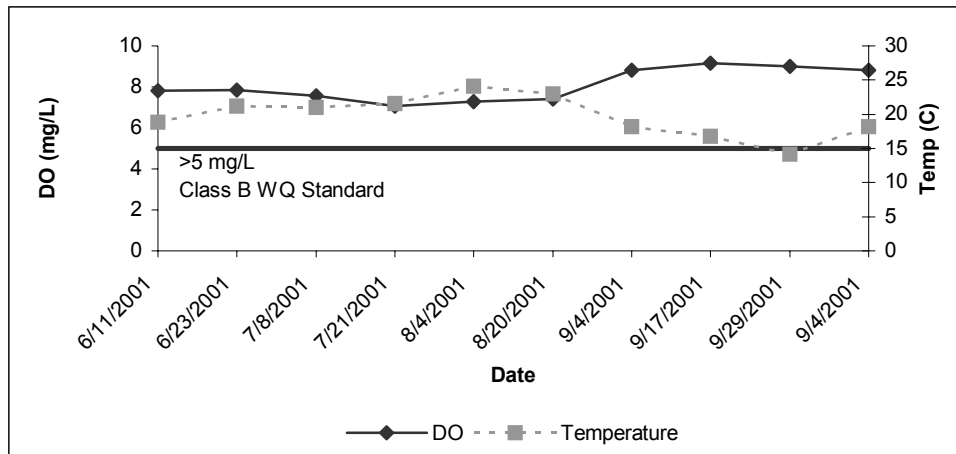
**Table 1. Monitoring Summary: 13'-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	18	18	0	7.07 - 9.16	>5
DO (% sat.)	18	18	0	80 - 94.5	>75
pH (std. units)	18	18	1	5.87 - 7.6	6.5-8.0
Turbidity (NTU)	18	18	0	0.7 - 5.4	<10 above background
Conductivity (µmho/cm)	18	18	0	143.5 - 230.1	NA
<i>E. coli</i> (CTS/100mL)	10	10	1	20 - 620	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

##### 4.1.1.1. Dissolved Oxygen

Dissolved oxygen in the river at 13'-Lmp remained well above the minimum required concentration of 5 mg/L (see Figure 1). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum daily average saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day.



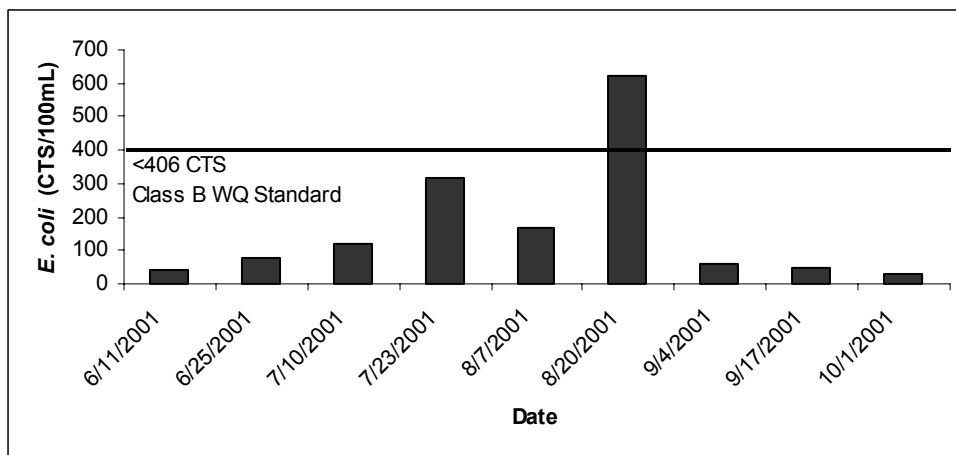
**Figure 1. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 13'-Lmp, Mill Street Bridge, Exeter, NH. VRAP, Year 2001.**

#### 4.1.1.2. pH

The pH at this location, ranging from 5.87 to 7.60, was measured below the state standard range on one of 18 occasions. Station conditions are considered along with pH measurements because of the narrative portion of the pH standard. If the sampling location is influenced by natural conditions, low pH measurements are not considered a violation of water quality standards. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. The pH of surface waters can be affected by soil, subsurface bedrock, and wetlands near the river or stream. In addition, rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels. Additional sampling is needed at this station.

#### 4.1.1.3. *E. coli*

The instantaneous *E. coli* counts were well below the standard for the summer of 2001, except on August 20 (Figure 2). The spike may have been the result of the presence of wildlife or waterfowl at the time of sampling, or immediately before sampling.



**Figure 2. *E. coli* Bacteria Counts. Lamprey River at 13'-Lmp. Mill Street Bridge, Epping, NH. VRAP, Year 2001.**

#### 4.1.2. Recommendations

- *Baseline Monitoring:* Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better documentation of water quality, as related to New Hampshire surface water quality standards.

For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- *E. coli:* Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.
- *Dissolved Oxygen:* Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours. This could be done by using a Hydrolab® DataSonde 4a multiprobe, which is an instrument that can collect data at specific time intervals (e.g., every 1-hour). The instrument can be put in the stream and left alone for a period of several days. The use of this instrument is dependent upon availability, and requires coordination with DES.

## 4.2. 13-Lmp: Route 125 Bridge, Epping, NH

See map in Section 3.1 for station location.

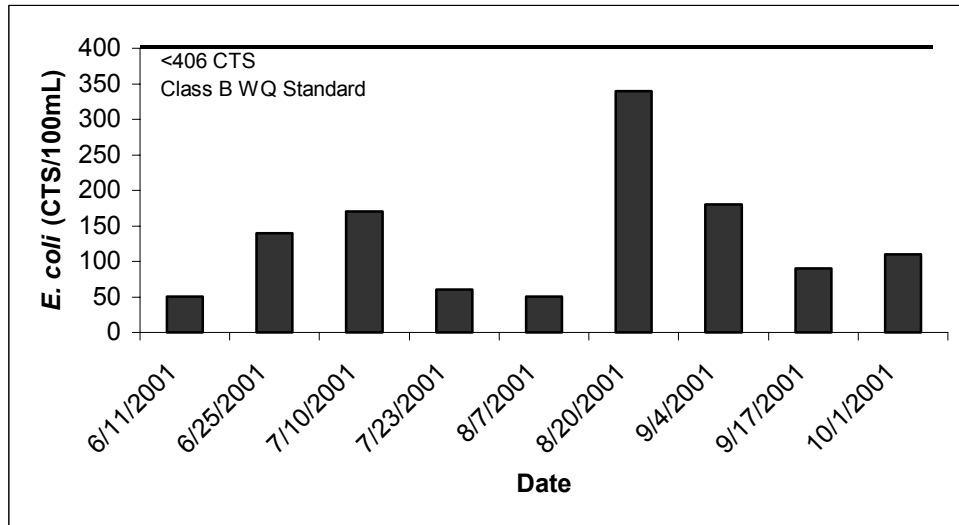
### 4.2.1. Results and Discussion

Nine samples were collected for *E. coli* bacteria (Table 2). All samples met the QA/QC requirements, and all results were below the instantaneous Class B water quality standards for this parameter (Figure 3).

**Table 2. Monitoring Summary: 13-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
<i>E. coli</i> (CTS/100mL)	9	9	0	50 - 340	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.



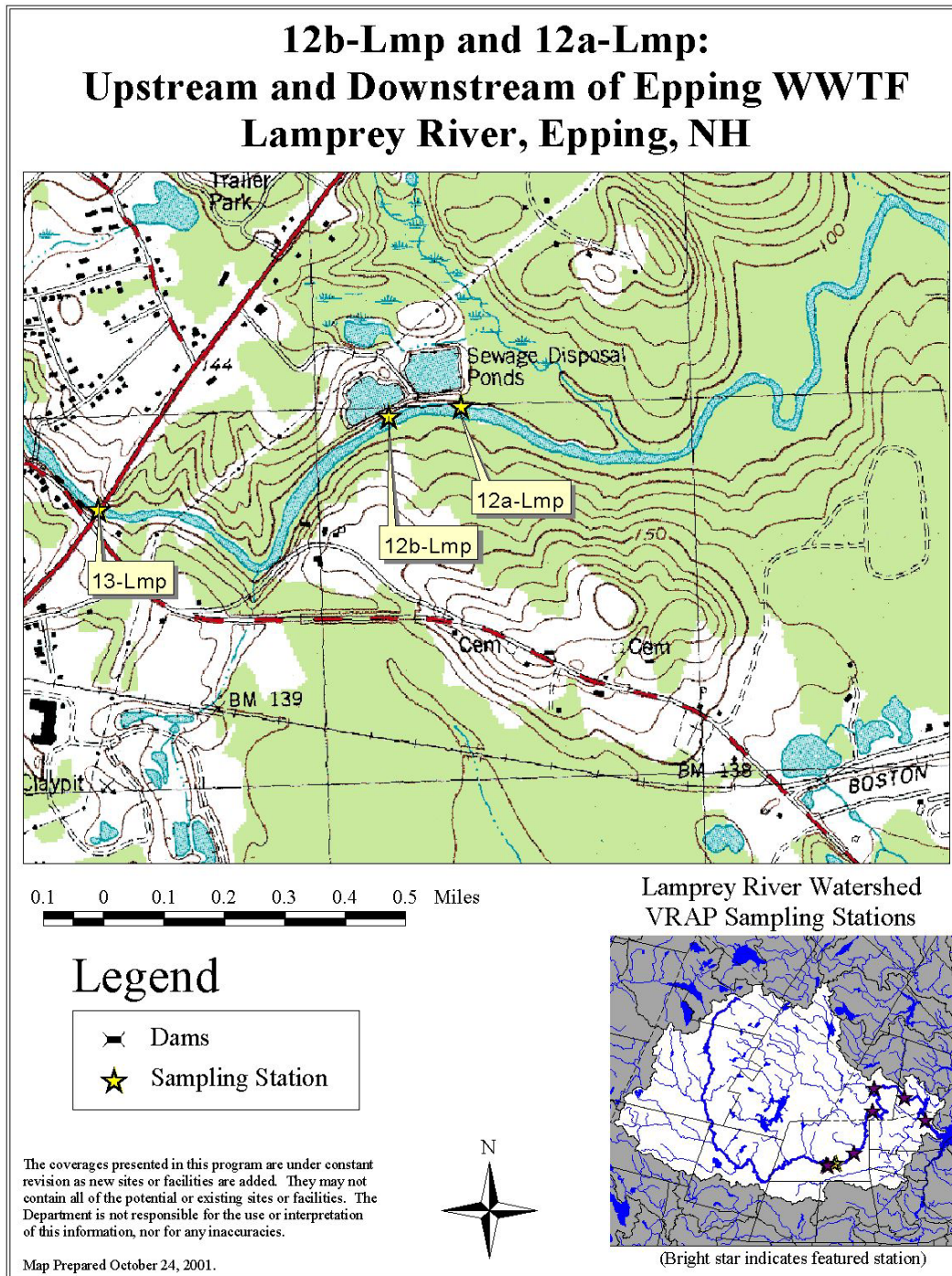
**Figure 3. *E. coli* Bacteria Counts. Lamprey River at 13-Lmp, Route 125 Bridge, Epping, NH. VRAP, Year 2001.**

#### 4.2.2. Recommendations

- *E. coli*: Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.



#### 4.3. 12b-Lmp: Upstream of Epping WWTF, Epping, NH



#### 4.3.1. Results and Discussion

Nine measurements for dissolved oxygen, pH, turbidity, and conductivity, were made in the field using handheld meters (Table 3). Nine samples were collected for *E. coli* bacteria. All measurements and samples, except one measurement for turbidity, met the QA/QC requirements. One pH measurement was outside the Class B water quality standard range. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.3.1.1, below).

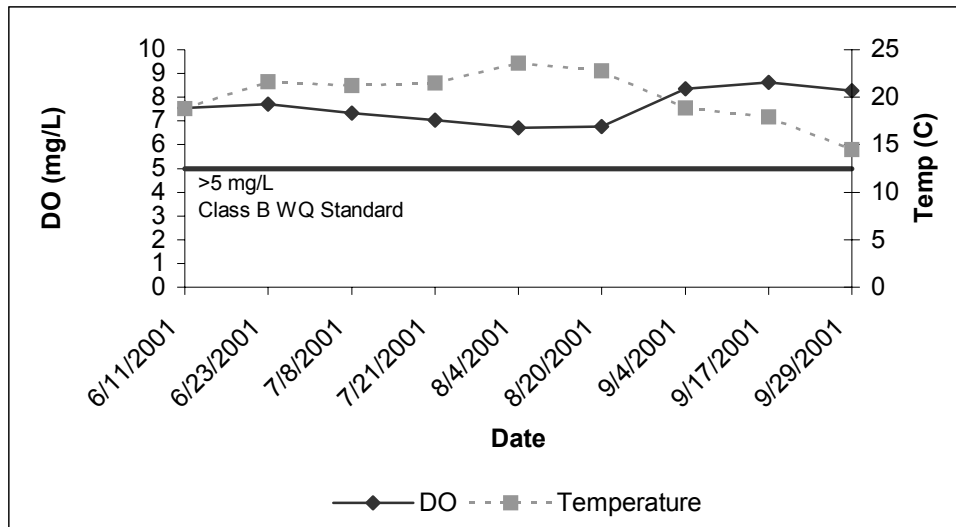
**Table 3. Monitoring Summary: 12b-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	9	9	0	6.71 - 8.62	>5
DO (% sat.)	9	9	0	78.6 - 90.8	>75
pH (std. units)	9	9	1	6.61 - 8.06	6.5-8.0
Turbidity (NTU)	9	8	0	0.8 - 2.21	<10 above background
Conductivity (µmho/cm)	9	9	0	147 - 229.4	NA
<i>E. coli</i> (CTS/100mL)	9	9	0	30 - 320	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

##### 4.3.1.1. Dissolved Oxygen

Figure 4 shows the DO concentration and water temperature during 2001. The Class B New Hampshire surface water quality standards for DO include a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % sat. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Thus, additional % saturation data are necessary from this station.



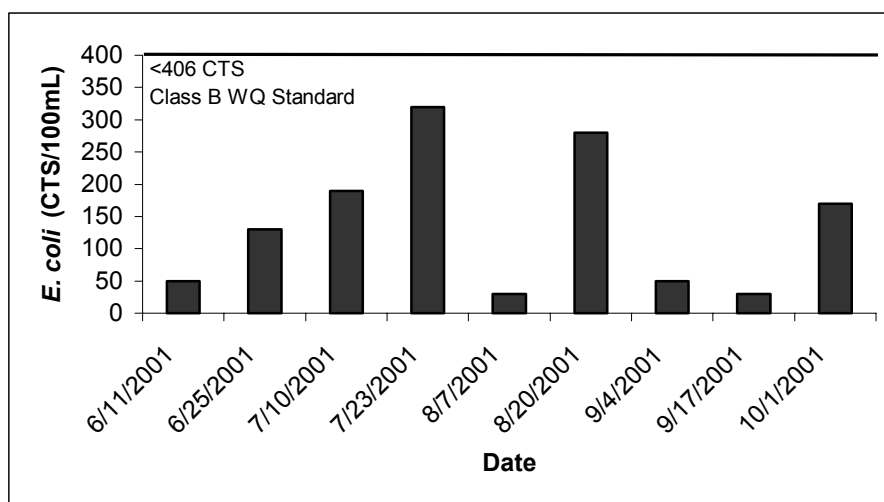
**Figure 4. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 12b-Lmp, Upstream of Epping WWTF, Epping, NH. VRAP, Year 2001.**

#### 4.3.1.2. pH

The pH at this location, ranging from 6.61 to 8.06, was measured outside of the standard range on one of nine occasions. Station conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. The pH of surface waters can be affected by soil, subsurface bedrock, and wetlands near the river or stream. Since the 8.06 measurement is not typical at this station, additional sampling is needed at this station.

#### 4.3.1.3. *E. coli*

The instantaneous *E. coli* counts at 12b-Lmp were within standards throughout the summer of 2001 (see Figure 5).



**Figure 5. *E. coli* Bacteria Counts. Lamprey River at 12b-Lmp, Upstream of Epping WWTF, NH. VRAP, Year 2001.**

#### 4.3.2. Recommendations

- **Baseline Monitoring:** Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better documentation of water quality, as related to New Hampshire surface water quality standards.

For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- ***E. coli*:** Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.
- **Dissolved Oxygen:** Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours. This could be done by using a Hydrolab® DataSonde 4a multiprobe, which is an instrument that can collect data at specific time intervals (e.g., every 1-hour). The instrument can be put in the stream and left alone for a period of several days. The use of this instrument is dependent upon availability, and requires coordination with DES.

#### 4.4. 12a-Lmp: Downstream of Epping WWTF, Epping, NH

See map in Section 3.3 for station location.

##### 4.4.1. Results and Discussion

Nine measurements for dissolved oxygen, pH, turbidity, and conductivity, were made in the field using handheld meters (Table 4). Nine samples were collected for *E. coli* bacteria. All measurements and samples met the QA/QC requirements. One DO saturation measurement was less than 75%. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.4.1.1, below).

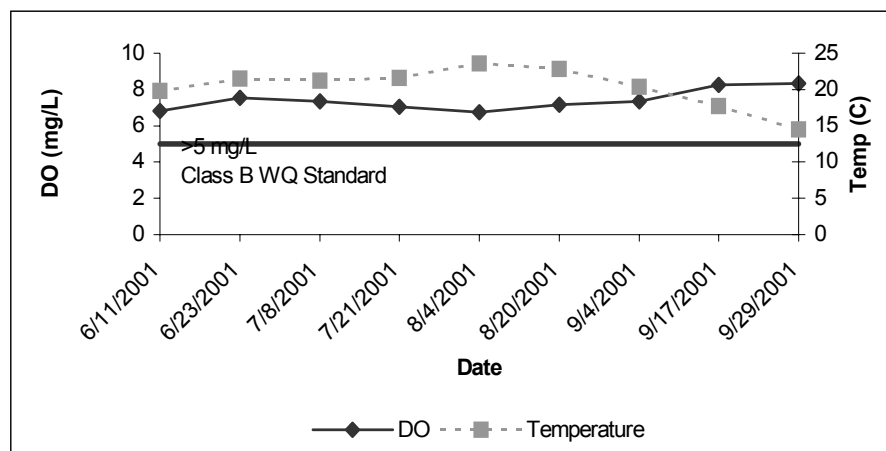
**Table 4. Monitoring Summary: 12a-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	9	9	0	6.73 - 8.33	>5
DO (% sat.)	9	9	1	74.7 - 86.2	>75
pH (std. units)	9	9	0	6.69 - 7.62	6.5-8.0
Turbidity (NTU)	9	9	0	0.8 - 13	<10 above background
Conductivity (µmho/cm)	9	9	0	184.5 - 800.68	NA
<i>E. coli</i> (CTS/100mL)	9	9	0	20 - 320	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

#### 4.4.1.1. Dissolved Oxygen

Figure 6 shows the DO concentration and water temperature during 2001. The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum daily average saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Thus, additional % saturation data are necessary from this station.



**Figure 6. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 12a-Lmp, Downstream of Epping WWTF, Epping, NH. VRAP, Year 2001.**

#### 4.4.1.2. *E. coli*

The instantaneous *E. coli* counts at 12a-Lmp were within standards throughout the summer of 2001 (see Figure 7). Counts were slightly higher in July and August, which may have been the result of increased wildlife or waterfowl congregations in the area.

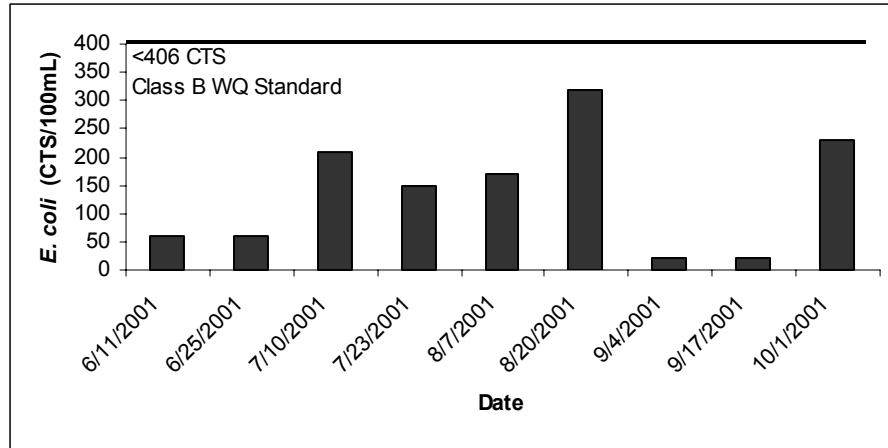


Figure 7. *E. coli* Bacteria Counts. Lamprey River at 12a-Lmp, Downstream of Epping WWTF, Epping, NH. VRAP, Year 2001.

#### 4.4.2. Recommendations

- **Baseline Monitoring:** Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better documentation of water quality, as related to New Hampshire surface water quality standards.

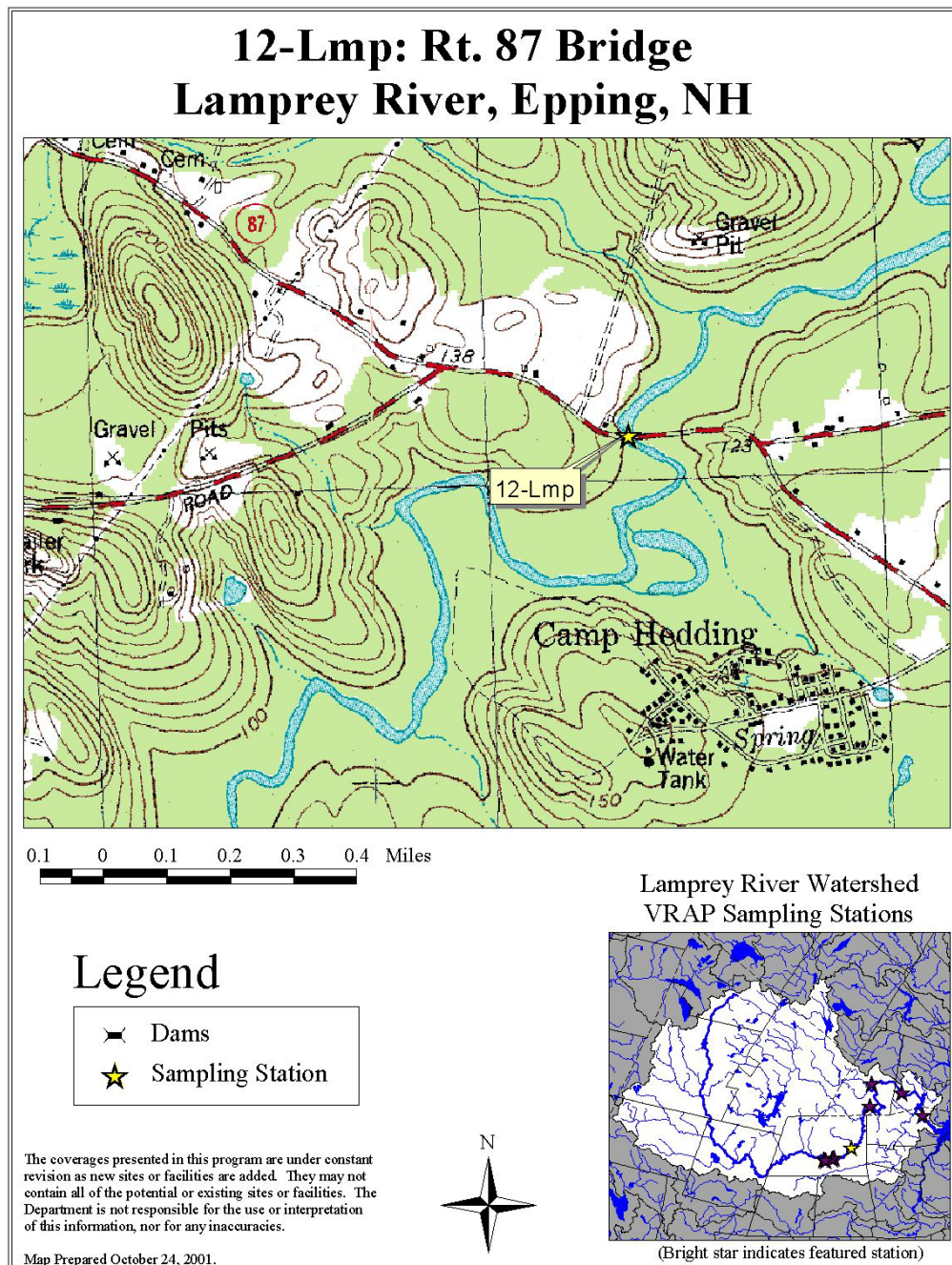
For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- ***E. coli*:** Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.
- **Dissolved Oxygen:** Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered



as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours. This could be done by using a Hydrolab® DataSonde 4a multiprobe, which is an instrument that can collect data at specific time intervals (e.g., every 1-hour). The instrument can be put in the stream and left alone for a period of several days. The use of this instrument is dependent upon availability, and requires coordination with DES.

#### 4.5. 12-Lmp: Route 87 Bridge, Epping, NH



#### 4.5.1. Results and Discussion

Nine measurements for dissolved oxygen, pH, turbidity, and conductivity, were made in the field using handheld meters (Table 5). Nine samples were collected for *E. coli* bacteria. All measurements and samples met the QA/QC requirements. Three DO saturation measurements were less than 75%. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.5.1.1, below).

**Table 5. Monitoring Summary: 12-Lmp. VRAP, Year 2001.**

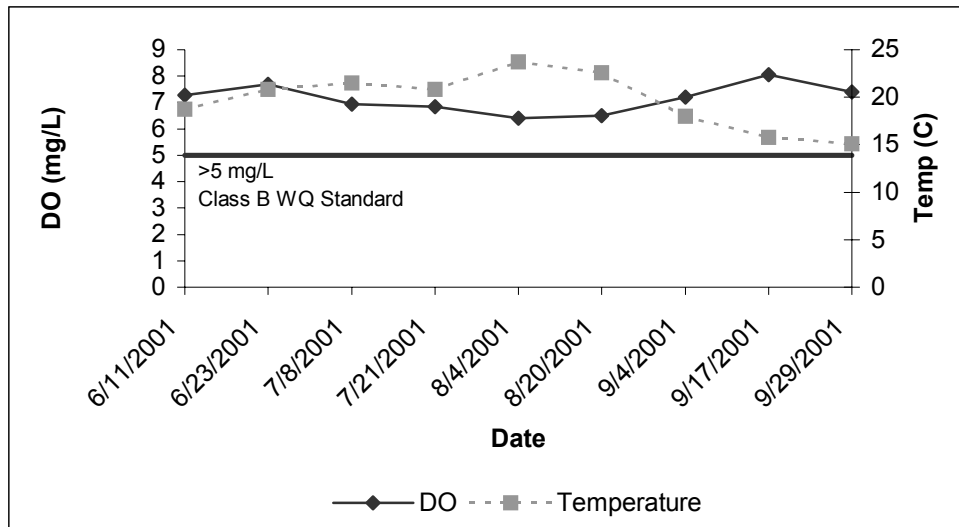
Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	9	9	0	6.4 - 8.06	>5
DO (% sat.)	9	9	3	73 - 85.9	>75
pH (std. units)	9	9	0	6.68 - 7.26	6.5-8.0
Turbidity (NTU)	9	9	0	1.1 - 2.4	<10 above background
Conductivity (µmho/cm)	9	9	0	155.2 - 319.9	NA
<i>E. coli</i> (CTS/100mL)	9	9	0	10 - 270	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

##### 4.5.1.1. Dissolved Oxygen

Dissolved oxygen in the river at 12-Lmp was always above the minimum required concentration of 5 mg/L (Figure 8). The Class B New Hampshire surface water quality standard for DO is a minimum concentration of 5.0 mg/L **and** minimum saturation of 75%. In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Additional sampling is necessary at this station.

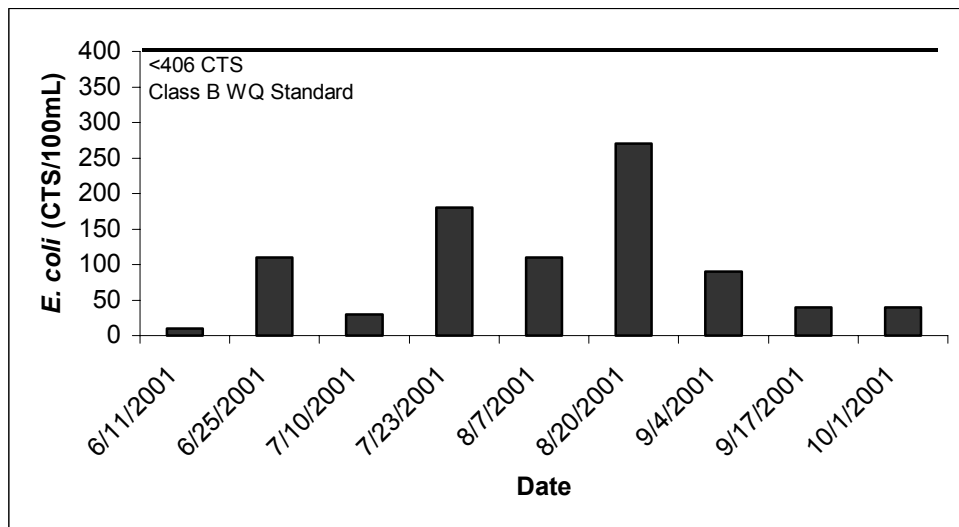




**Figure 8. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 12-Lmp, Route 87 Bridge, Epping, NH. VRAP, Year 2001.**

#### 4.5.1.2. *E. coli*

The instantaneous *E. coli* counts were within the state standard throughout the summer of 2001 (Figure 9)



**Figure 9. *E. coli* Bacteria Counts. Lamprey River at 12-Lmp, Route 87 Bridge, Epping, NH. VRAP, Year 2001.**

#### 4.5.2. Recommendations

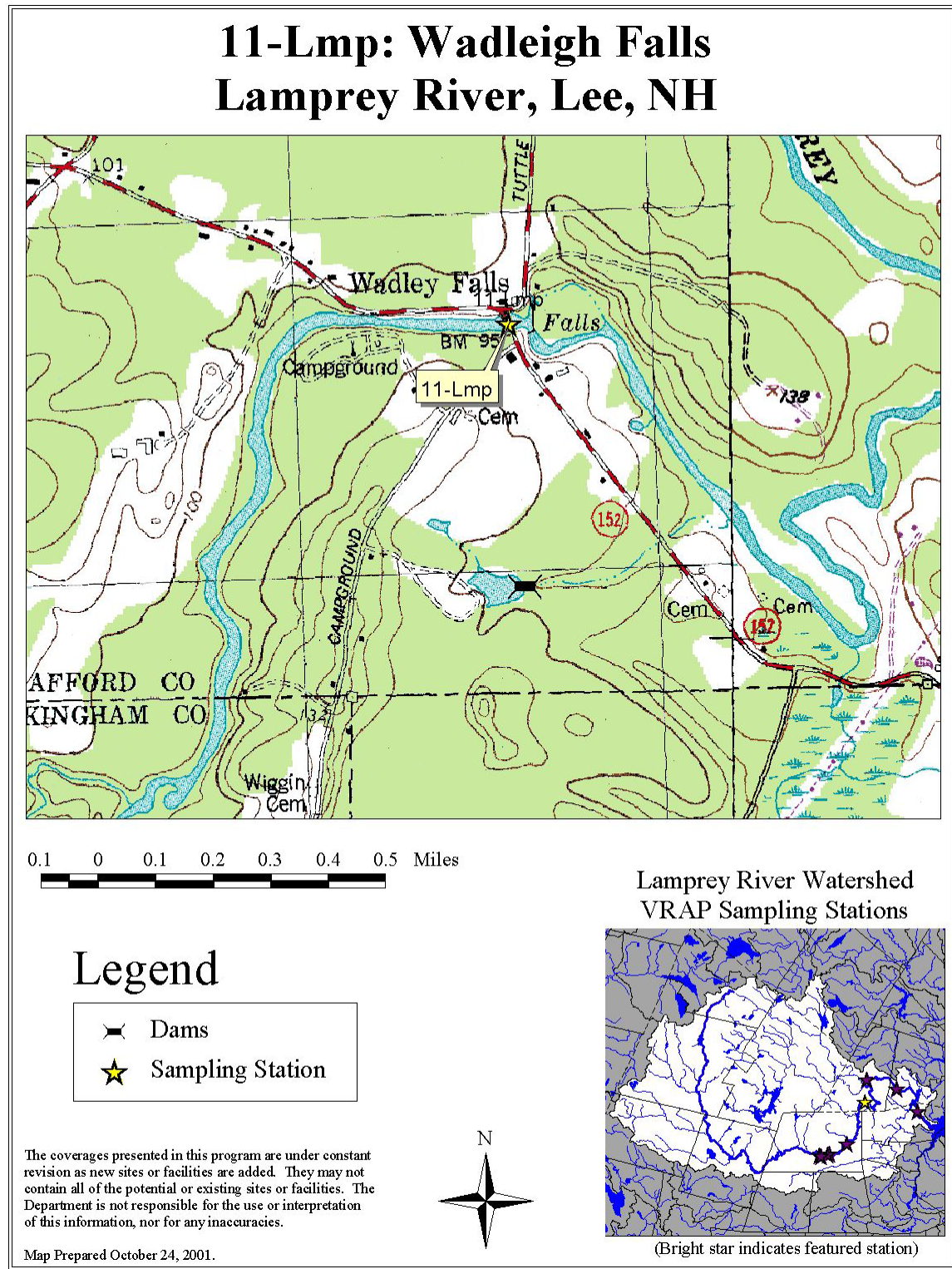
- **Baseline Monitoring:** Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better

documentation of water quality, as related to New Hampshire surface water quality standards.

For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- *E. coli*: Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.
- *Dissolved Oxygen*: Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours. This could be done by using a Hydrolab® DataSonde 4a multiprobe, which is an instrument that can collect data at specific time intervals (e.g., every 1-hour). The instrument can be put in the stream and left alone for a period of several days. The use of this instrument is dependent upon availability, and requires coordination with DES.

#### 4.6. 11-Lmp: Wadley Falls, Lee, NH



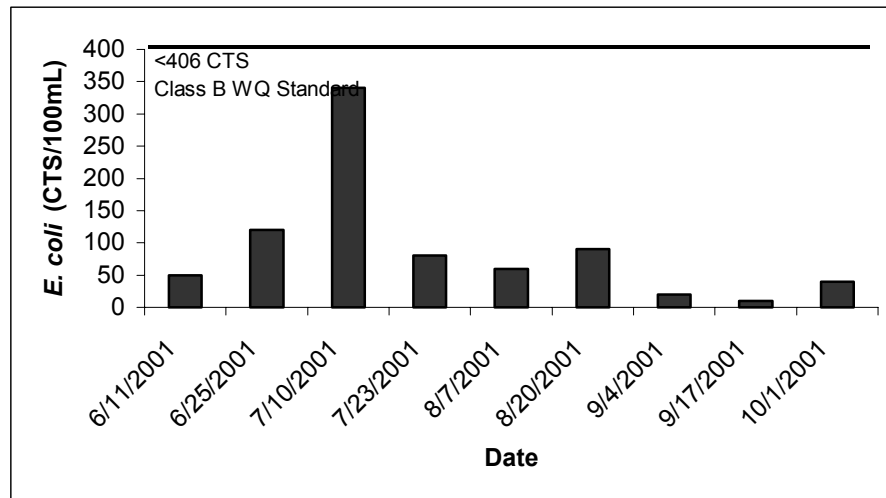
#### 4.6.1. Results and Discussion

Nine samples were collected for *E. coli* bacteria (Table 6). All samples met the QA/QC requirements, and all results were below the instantaneous Class B water quality standards for this parameter (Figure 10).

**Table 6. Monitoring Summary: 11-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
<i>E. coli</i> (CTS/100mL)	9	9	0	10 - 340	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.



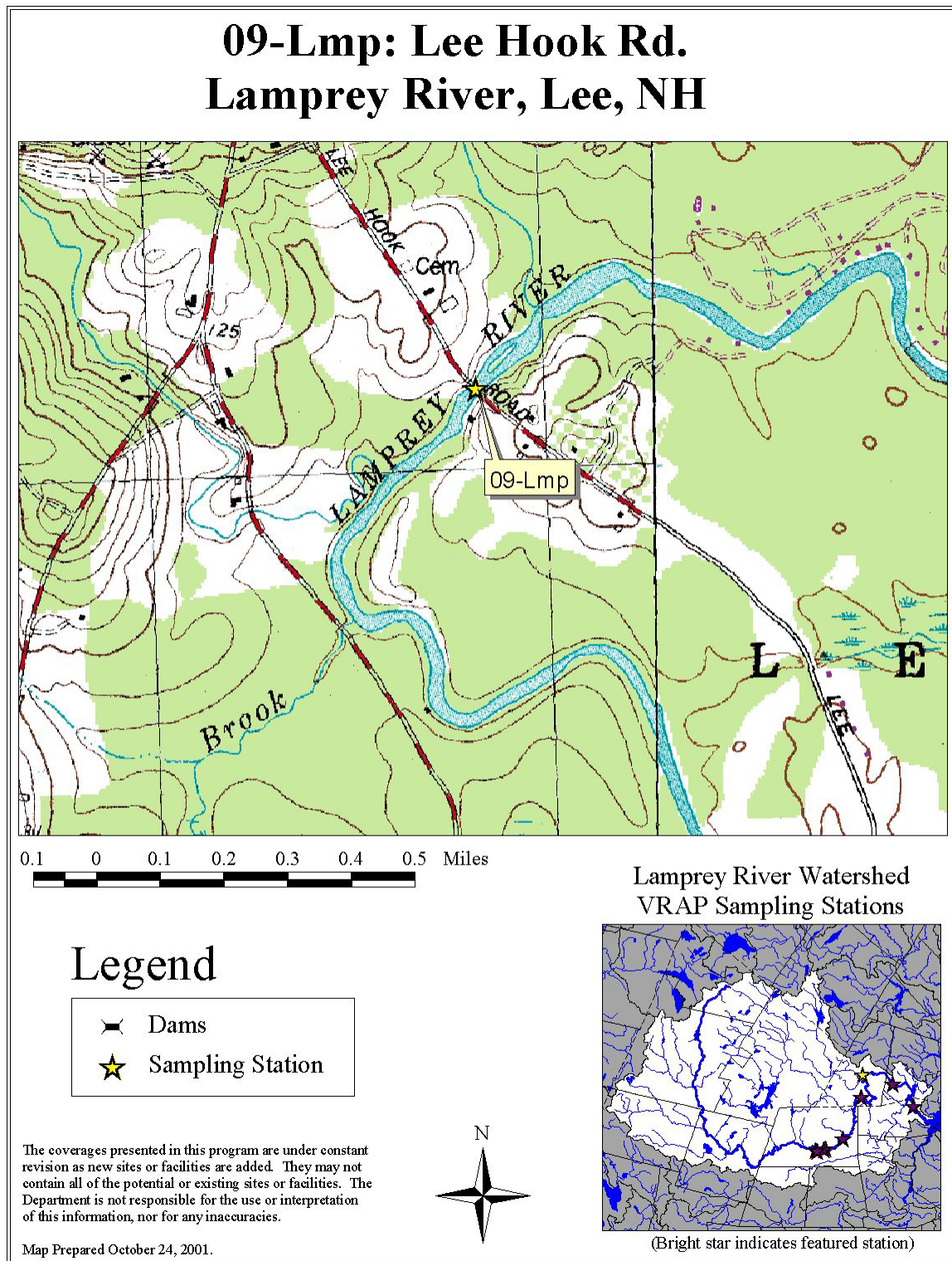
**Figure 10. *E. coli* Bacteria Counts. Lamprey River at 11-Lmp, Wadley Falls, Lee, NH. VRAP, Year 2001.**

#### 4.6.2. Recommendations

- *E. coli*: Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.



#### 4.7. 09-Lmp: Lee Hook Rd, Lee, NH



#### 4.7.1. Results and Discussion

Nine measurements for dissolved oxygen, pH, turbidity, and conductivity, were made in the field using handheld meters (Table 7). All measurements met the QA/QC requirements. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.7.1.1, below).

**Table 7. Monitoring Summary: 09-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	9	9	0	7.01 - 8.13	>5
DO (% sat.)	9	9	0	78 - 88.9	>75
pH (std. units)	9	9	0	6.84 - 7.3	6.5-8.0
Turbidity (NTU)	9	9	0	0.6 - 2.2	<10 above background
Conductivity (µmho/cm)	9	9	0	128.4 - 251.9	NA

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

##### 4.7.1.1. Dissolved Oxygen

Dissolved oxygen concentrations remained above the minimum instantaneous requirement of 5 mg/L throughout the summer (Figure 11). The Class B New Hampshire surface water quality standards for DO include a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % of saturation (% sat.). In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Thus, additional % saturation data are necessary from this station.

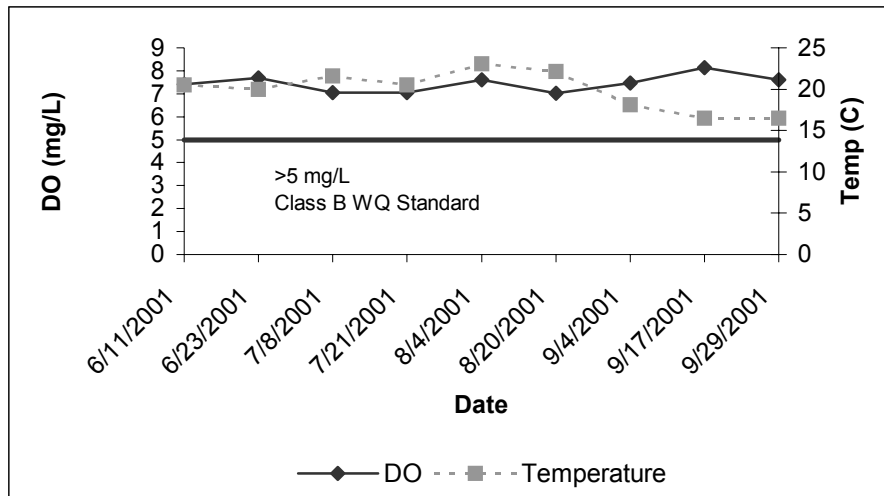


Figure 11. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 09-Lmp, Lee Hook Rd, Lee, NH. VRAP, Year 2001.

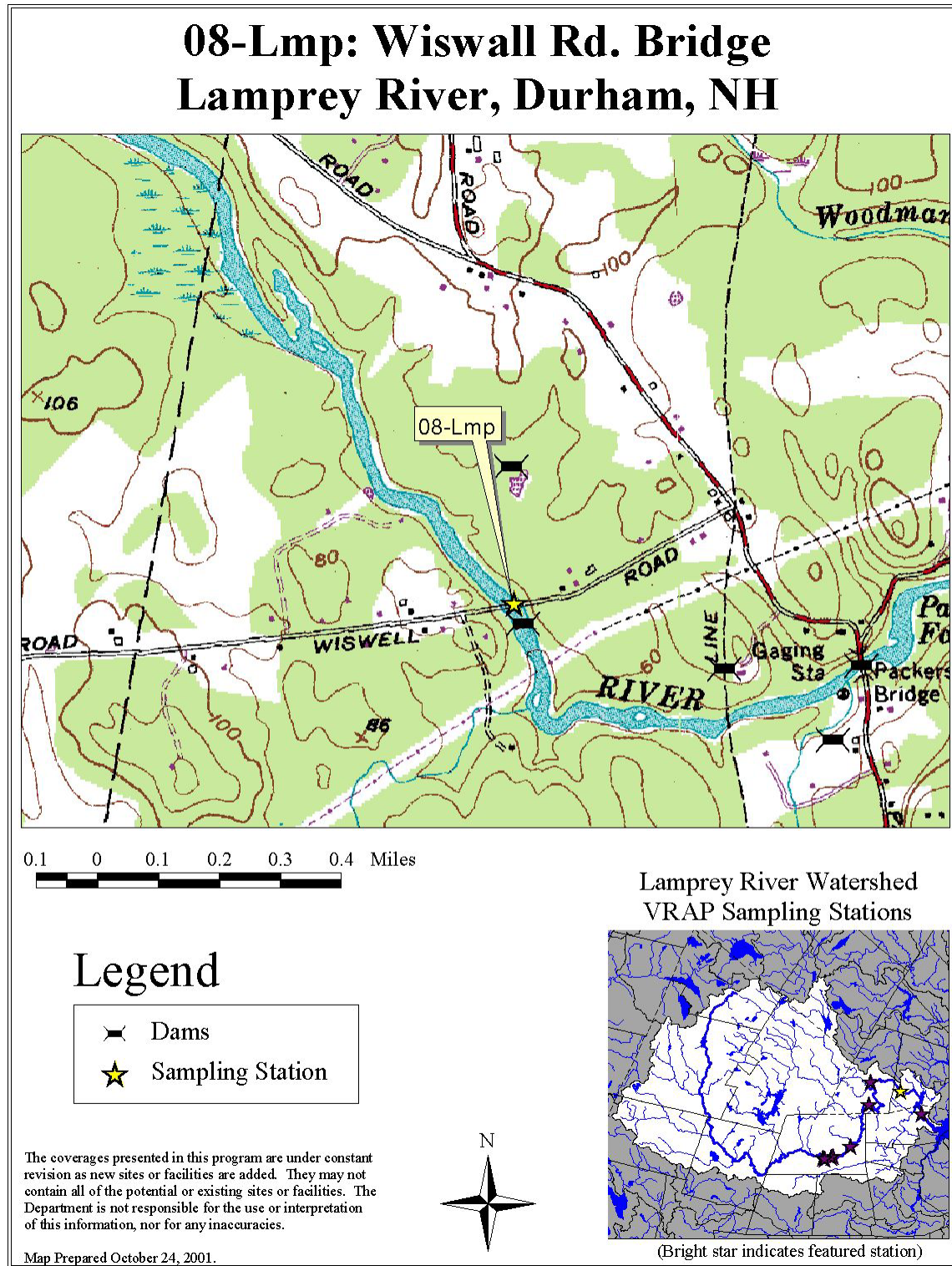
#### 4.7.2. Recommendations

- *Baseline Monitoring:* Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better documentation of water quality, as related to New Hampshire surface water quality standards.

For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- *Dissolved Oxygen:* Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours. This could be done by using a Hydrolab® DataSonde 4a multiprobe, which is an instrument that can collect data at specific time intervals (e.g., every 1-hour). The instrument can be put in the stream and left alone for a period of several days. The use of this instrument is dependent upon availability, and requires coordination with DES.

#### 4.8. 08-Lmp: Wiswall Road Bridge, Durham, NH





#### 4.8.1. Results and Discussion

Nine measurements for dissolved oxygen, pH, turbidity, and conductivity, were made in the field using handheld meters (Table 8). Ten samples were collected for *E. coli* bacteria. All measurements and samples met the QA/QC requirements. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.8.1.1, below).

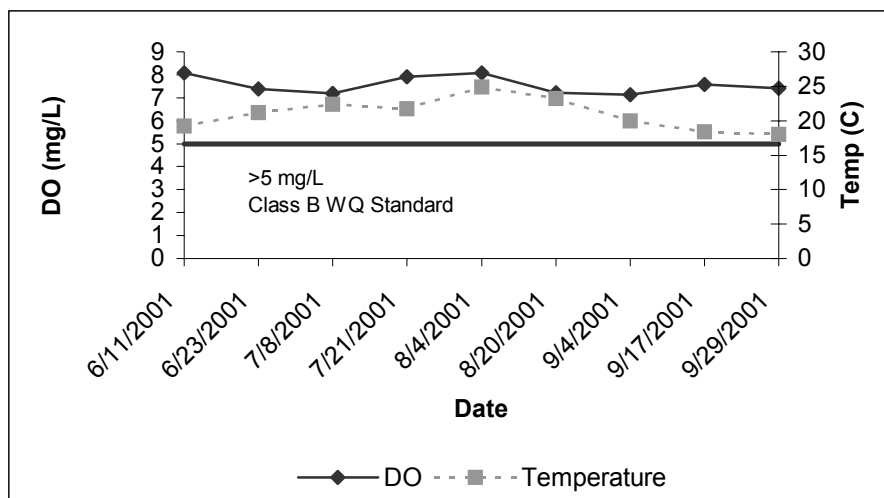
**Table 8. Monitoring Summary: 08-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	9	9	0	7.12 - 8.08	>5
DO (% sat.)	9	9	0	78.1 - 97.2	>75
pH (std. units)	9	9	0	6.78 - 7.32	6.5-8.0
Turbidity (NTU)	9	9	0	0.8 - 2.4	<10 above background
Conductivity (µmho/cm)	9	9	0	129.3 - 207.5	NA
<i>E. coli</i> (CTS/100mL)	10	10	0	<10 - 360	<406

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

##### 4.8.1.1. Dissolved Oxygen

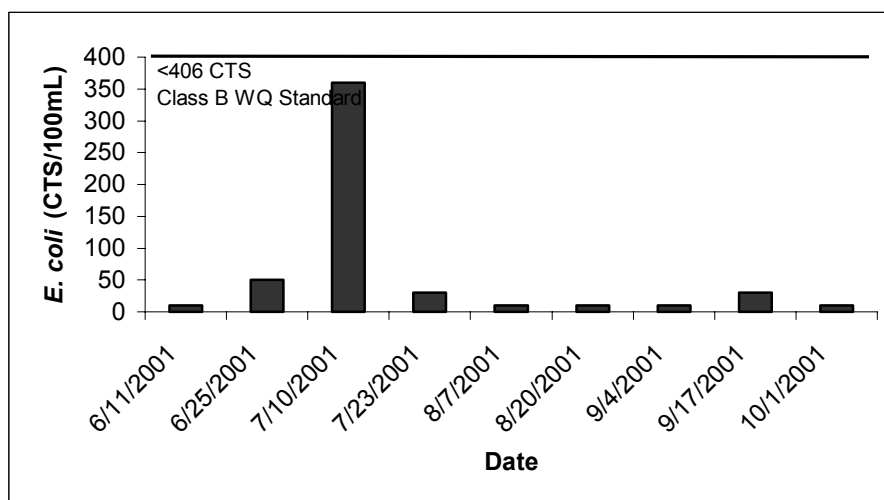
Dissolved oxygen concentrations remained above the minimum instantaneous requirement of 5 mg/L (Figure12). The Class B New Hampshire surface water quality standards for DO include a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % of saturation (% sat.). In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Thus, additional % saturation data are necessary from this station.



**Figure 12. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 08-Lmp, Wiswall Road Bridge, Durham, NH. VRAP, Year 2001.**

#### 4.8.1.2. *E. coli*

The instantaneous *E. coli* counts were within the state standard throughout the summer of 2001 (Figure 13).



**Figure 13. *E. coli* Bacteria Counts. Lamprey River at 08-Lmp, Wiswall Road Bridge, Durham, NH. VRAP, Year 2001.**

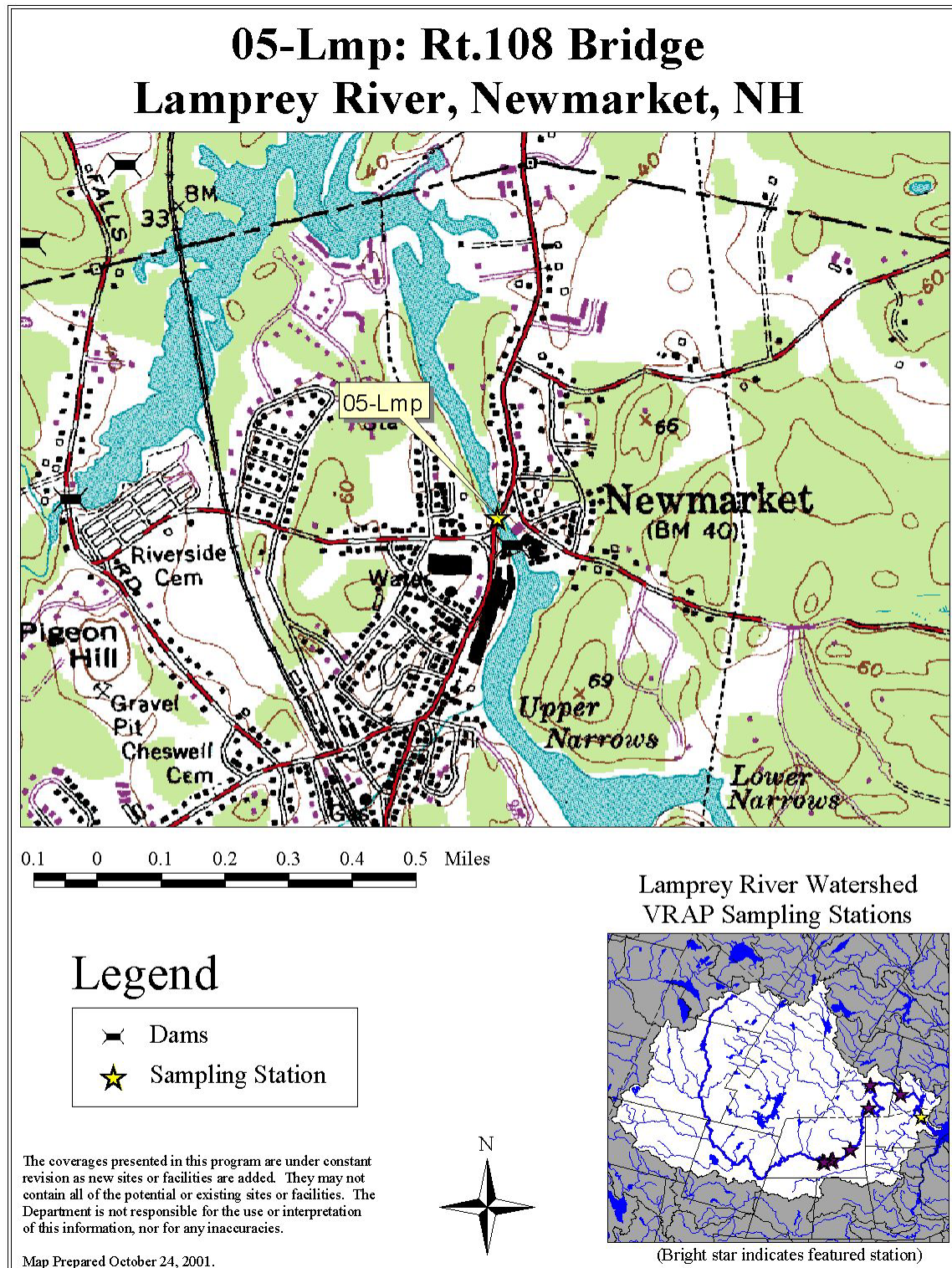
#### 4.8.2. Recommendations

- **Baseline Monitoring:** Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better documentation of water quality, as related to New Hampshire surface water quality standards.

For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- *E. coli*: Continued *E. coli* sampling at this station is encouraged, as *E. coli* can influence the recreational use of the river. Therefore it is important to monitor *E. coli*, especially where swimming might be expected. Volunteers should continue to collect at least three samples during a 60-day period, which allows the NHDES to determine the geometric mean of *E. coli*. A geometric mean is a type of average that better describes *E. coli* levels relative to the natural characteristics of *E. coli* in water.
- *Dissolved Oxygen*: Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours.

#### 4.9. 05-Lmp: Rte 108 Bridge, Newmarket, NH



#### 4.9.1. Results and Discussion

Eleven measurements for dissolved oxygen, pH, turbidity, and conductivity were made in the field using handheld meters (Table 9). All measurements and samples met the QA/QC requirements. Four DO saturation measurements were less than 75%. The DO concentration data do not show any apparent DO problems, but these data alone do not accurately characterize DO relative to the surface water quality standards (see explanation in Section 4.9.1.1, below).

**Table 9. Monitoring Summary: 05-Lmp. VRAP, Year 2001.**

Parameter	Samples Collected	Samples Meeting QA/QC Requirements	Acceptable Samples Not Meeting State Criteria	Data Range	Standards*
DO (mg/L)	11	11	0	5.45 - 8.99	>5
DO (% sat.)	11	11	4	58.8 - 99.8	>75
pH (std. units)	11	11	0	6.69 - 7.61	6.5-8.0
Turbidity (NTU)	11	11	0	0.45 - 3.4	<10 above background
Conductivity (µmho/cm)	11	11	0	127.6 - 195.5	NA

\*Abbreviated standard values have been used in this table for quick reference. Please see Env-Ws 1700 and RSA 485-A:8 for complete Surface Water Quality Regulations.

##### 4.9.1.1. Dissolved Oxygen

Dissolved oxygen concentrations remained above the minimum instantaneous requirement of 5 mg/L throughout the summer (See Figure 14). The Class B New Hampshire surface water quality standards for DO include a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % of saturation (% sat.). In other words, there are criteria for both concentration and saturation that must be met before the river can be considered as meeting DO standards. An accurate determination of whether the DO standard is met for % saturation can only be done using multiple measurements of saturation collected during any single day. Thus, additional % saturation data are necessary from this station.

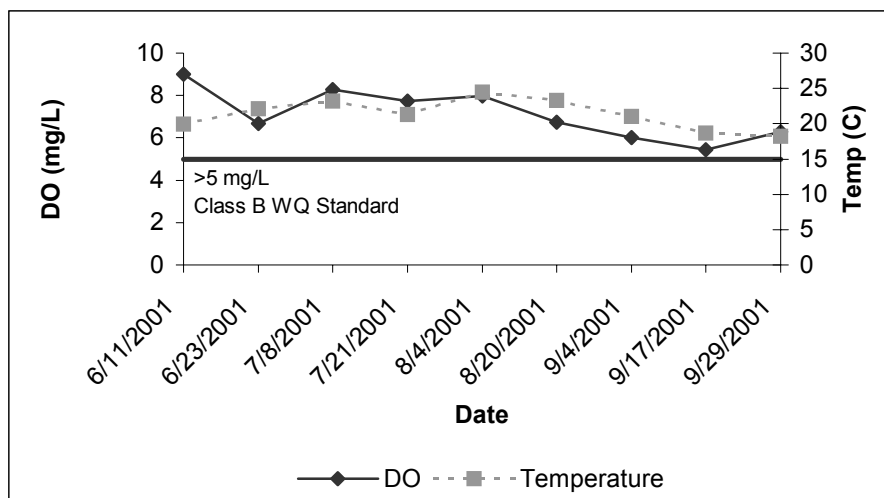


Figure 14. Dissolved Oxygen (DO) Concentration vs. Temperature. Lamprey River at 05-Lmp, Rte 108 Bridge, Newmarket, NH. VRAP, Year 2001.

#### 4.9.2. Recommendations

- **Baseline Monitoring:** Volunteers are encouraged to continue sampling for all parameters, especially DO and pH, at this station. More information in the baseline data set will allow for a better understanding of the variations that the river encounters during the year. In addition, this will allow for better documentation of water quality, as related to New Hampshire surface water quality standards.

For an increased understanding of water quality conditions at the time of sampling, volunteers should remember to be specific about the weather conditions and other characteristics of the sampling station.

- **Dissolved Oxygen:** Measurements should continually be made at this station on a routine basis. This will help document variations in the river, and provide early detection of changes in the river. As previously stated, there are criteria for both concentration **and** saturation that must be met before the river can be considered as meeting DO standards. Volunteers are encouraged to measure DO early in the early morning and during the mid-afternoon hours. This could be done by using a Hydrolab® DataSonde 4a multiprobe, which is an instrument that can collect data at specific time intervals (e.g., every 1-hour). The instrument can be put in the stream and left alone for a period of several days. The use of this instrument is dependent upon availability, and requires coordination with DES.

Appendix A:  
List of Stations

Appendix B:  
Raw Data Tables



Appendix C:

Parameters and Surface Water Quality Standards

Appendix D:  
River Graphs

Appendix E:

Field Sampling Protocols